

What is Claimed Is:

1. A fuel cell stack comprising:

at least one cell A, which comprises a first and second separator disposed between and contacting opposing surfaces of an MEA, wherein the first separator has an inlet manifold to direct gas to and across one surface of the MEA and an outlet manifold linked to the inlet manifold to direct gas away from the one surface of the MEA; and

at least one cell B, which comprises a first and second separator disposed between and contacting opposing surfaces of an MEA, wherein the first separator has a first and second inlet manifold to direct gas to and across one surface of the MEA and a first and second outlet manifold linked to the first and second inlet manifolds, respectively, to direct gas away from the one surface of the MEA,

wherein the outlet of the first separator of cell A is linked to the second inlet manifold of the first separator of cell B.

2. The fuel cell stack according to claim 1:

wherein the second separator of cell A comprises an inlet manifold to direct gas to and across the other surface of the MEA and an outlet manifold linked to the inlet manifold to direct gas away from the other surface of the MEA;

wherein the second separator of cell B comprises a first and second inlet manifold to direct gas to and across the other surface of the MEA and a first and second outlet manifold linked to the first and second inlet manifolds, respectively, to direct gas away from the other surface of the MEA; and

wherein the outlet manifold of the second separator of cell A is linked to the second inlet manifold of the second separator of cell B.

3. The fuel cell stack according to claim 2 further comprising:

a first valve linked to the first inlet manifold of the first separator of cell B;

a second valve linked to the inlet manifold of the first separator of cell A;

a third valve linked to the first inlet manifold of the second separator of cell B;
a fourth valve linked to the inlet manifold of the second separator of cell A;
a fifth valve linked to the second outlet manifold of the first separator of cell B;
a sixth valve linked to the outlet manifold of the second separator of cell A;
a seventh valve linked to the outlet manifold of the second separator of cell A and the first outlet manifold of the second separator of cell B; and
an eight valve linked to the gas outlet of the first separator of cell A and to the first outlet manifold of the first separator of cell B.

4. The fuel cell stack according to claim 3 further comprising a controller to open and close the first through eight valves.

5. The fuel cell stack according to claim 4 wherein the controller opens or closes any one of the first through eight valves in response to a power mode of the fuel cell stack.

6. The fuel cell stack according to claim 5 wherein the controller operates cells A and B in parallel during a first power mode by opening valves 1, 2, 8, 3, 4 and 7 and closing the remaining valves; and wherein the controller operates cells A and B in series during a second power mode by opening valves 2, 5, 4, 6 and closing valves the remaining valves.

7. The fuel cell stack according to claim 2 wherein the first separators of cells A and B contact a cathode electrode surface of the MEA and the second separators of cells A and B contact the anode electrode surface of the MEA.

8. The fuel cell stack according to claim 2 wherein the fuel stack comprises a plurality of alternating cells of cell A and cell B.

9. A fuel cell stack comprising a plurality of unit cells, each of which comprises:

a first and second separator disposed between and contacting opposing surfaces of an MEA, wherein the first separator has at least two independent gas passages to supply gas across one surface of the MEA, and wherein each of the at least two independent gas passages has an inlet and an outlet manifold.

10. The fuel cell stack according to claim 9 wherein the at least two independent gas passages are connected in series by connecting the outlet manifold of an upstream gas passage and the inlet manifold of a downstream gas passage with pipes provided outside the first separator.

11. The fuel cell stack according to claim 10, further comprising a mist trap at the connection of the outlet and inlet manifolds.

12. The fuel cell stack according to claim 9 wherein the at least two gas passages of the first separator are arranged so that the direction of a gas flow is predominately in the direction consistent with gravity.

13. The fuel cell stack according to claim 9 wherein the second separator has at least two independent gas passages to supply gas across the other surface of the MEA, and wherein each of the at least two independent gas passages has an inlet and an outlet manifold.

14. The fuel cell stack according to claim 9 wherein the first separator has at least two independent cooling water passages on a surface opposing the MEA.

15. A fuel cell stack comprising:
a plurality of separators disposed between a plurality of MEAs; and
means for supplying gas to the plurality of separators parallelly during a first power mode and serially during a second power mode.

16. A method of operating a fuel cell stack, the method comprising:
supplying fuel gas to a plurality of cathode side separators in parallel during a first power mode; and
supplying fuel gas to the plurality of cathode side separators in series during a second power mode.

17. The method according to claim 16 wherein fuel gas is supplied to the plurality of cathode side separators in parallel by independently supplying the fuel gas to at least two of the plurality of cathode separators, and
wherein fuel gas is supplied to the plurality of cathode side separators in series by connecting an outlet manifold of one of the plurality of cathode side separators to an inlet manifold of another of the plurality of cathode side separators.

18. The method according to claim 16 wherein fuel gas is supplied to the plurality of cathode side separators in parallel by supplying the fuel gas to individual separators having independent gas passages, and
wherein the fuel gas is supplied to the plurality of cathode side separators in series by connecting an outlet manifold of one of the independent gas passages on each cathode side separator to an inlet manifold on the same separator.